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# EXPERIMENTAL EVIDENCE FOR HYBRID ORIGIN OF *DICHELOSTEMMA VENUSTUM* (LILIACEAE)

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In 1892, E. L. Greene described *Brevoortia venusta* from plants growing in the garden at the University of California, Berkeley, the corms of which had been obtained from the early California dealer in natives, Carl Purdy of Ukiah. Apparently Purdy read Greene's account of the species and in a letter to Greene of 16 July, 1892, wrote, "The *Brevoortia venusta* I know well. It is a hybrid between *Brodiaea congesta* and *Brevoortia Ida-Maia*. . . . I first heard of this plant some years ago, through Mr. J. H. Clarke of Cahto, Mendocino County, who had observed that where *Brevoortia* and *Brodiaea congesta* grew near each other, they occasionally crossed. A few years ago I found a few of the hybrids in my bulb beds, and ever since then they have occasionally appeared. In only one case have I seen more than a few together in a wild state." In reply to Purdy's letter, Greene wrote (Pittonia 2: 250–251), "Respecting the hybrid origin of *Brodiaea venusta*, I am not quite convinced that Messrs. Clarke and Purdy are correct. I should, at all events, need further evidence beyond the mere fact that the plant is found only where *B. Ida-Maia* (*Brevoortia*, Wood) and *B. congesta* grow together. It is characteristic of natural hybrids to differ greatly among themselves, some individuals bearing stronger resemblance to one of the parent species, others more like the other parent." This of course is true only in cases of fertile hybrids which segregate in advanced generations or backcross to the parental species. In the case of *Dichelostemma* the species reproduce asexually through the multiplication of corms as well as sexually and a sterile $F_1$ hybrid could maintain itself through asexual means.

Hoover (1940) was of the opinion that the combination of characters exhibited by *venustum* suggested a hybrid origin, an opinion also shared by Baker (1929) and Tracy (*in* Hoover). Baker's note is particularly interesting since in it he states, "These species (i.e., *B. congesta, venusta* & *idamaia*) are found growing within a few feet of each other, at the head of the South Fork of Yager Creek. . . ." Johansen (1932) was likewise certain that *venustum* was of hybrid origin but considered *D. capitatum* Wood (*D. pulchellum* (Salisb.) Heller) as the other species.

*Dichelostemma multiflorum* (Benth.) Heller seems not to have been considered as a possible parent except for the mention by Hoover (1940) that at the Highland Mine in Siskiyou County, none of the three species suggested as possible parents is known to occur although another species, *D. multiflorum* has been collected at the same locality.

The most recent author to consider *D. venustum* (Greene) Hoover, Keator (1968), believes that it "may represent stabilized hybrids between *D. ida-maia* and *D. congestum* or *D. parviflorum* which have arisen independently in several widely separated areas."

In the spring of 1965 flowers of *D. ida-maia* (Wood) Greene were emasculated and pollinated with a tetraploid form of *D. multiflorum*. The plants were grown in pots in an insectproof house to prevent accidental pollinations. Seed set was good and the seed was planted in the fall of 1965. The hybrid plants first bloomed in the spring of 1970 and it was immediately apparent that they were similar to, if not identical with, *D. venustum*. *Dichelostemma congestum* (Smith) Kunth was not used in the original

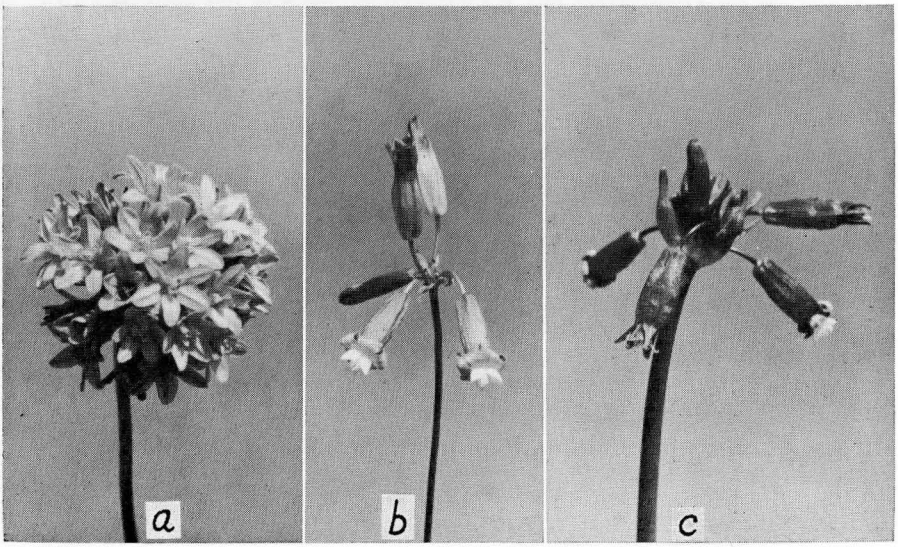


Fig. 1. a, *Dichelostemma multiflorum*; b. *D. ida-maia* × *D. multiflorum*; c. *D. ida-maia*.

hybridizations because at that time *congestum* was not represented in the living cultures at the botanic garden. *Dichelostemma congestum* and *D. multiflorum* are basically very similar, differing only in that the pedicels of *D. congestum* are joined toward the base and that the staminodia are deeply bifid at the apex, whereas in *D. multiflorum* the pedicels are distinct and the staminodia are broad, involute and entire at the apex. *Dichelostemma venustum* is described by Hoover (1940) as having pedicels free to the base and the staminodia somewhat involute and rounded at the apex. The pedicels and staminodia of the hybrid plants are similar to a specimen of *D. venustum* collected five miles from Sawyer's Bar on the road to Cecilville (*E. K. Balls 13955*).

It would thus appear that experimental evidence now substantiates early conjecture as to the hybrid nature of *D. venustum*. Since I have no hybrids between *D. ida-maia* and *D. congestum* that species cannot be ruled out as a possible parent. On morphological grounds the hybrid between *D. ida-maia* and *D. multiflorum* fits perfectly the description of *D. venustum* and that species has been found in association with *D. venustum* in at least one locality. Considering the ease with which this hybrid was produced in the garden and the fact that *D. congestum* and *D. multiflorum* are basically very similar and possess the same basic chromosome numbers it would seem entirely possible that either of these species might hybridize with *D. ida-maia* and produce similar hybrids differing perhaps only in the form of the staminodia, a feature that should be carefully observed in plants of this species collected in the field.

Keator (1968) reported *D. venustum* to have $n=24$ chromosomes (p. 51) or a diploid number of ca. 48 (p. 161). Root tip counts showed the hybrid described here to have 42 chromosomes, the number that would be expected since the *D. multiflorum* used was a tetraploid with $2n=36$ chromosomes and the *D. ida-maia* had $2n=48$. The latter species is apparently a hexaploid based on $x=8$. In addition it may have 0–6 B-chromosomes. In a hybrid between two autopolyploid species pairing might be expected between homologous chromosomes within each of the species and the hybrid might be expected to behave as an amphidiploid. It was with this possibility in mind that a tetraploid *multiflorum* was selected to use in producing the hybrid. Fertility as determined by stainable pollen was 82.5%. An attempt is being made to reproduce this interesting plant through normal seed production.

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